**PROGRAM OF LABS AND SEMINARS ATS**

**Semester 1**

**Seminars**

1. Male sex cell - sperm. Spermatogenesis. Spermiogenesis. Sperm. Female germ cell - egg. Oogenesis. Vitellogenesis.
2. Fertilization and insemination. Cleavage and implantation. Placenta. Gastrulation. Embryonic disc: its development and transformation.
3. Early stages of development. Fetal membranes. Placenta. Environmental influences and birth defects. Multiple pregnancy.
4. The cell cycle and its regulation. Mitosis, Meiosis. Proliferation, proliferation stages. (45 min)
5. Types of cell death: apoptosis, necrosis, mitotic catastrophe, autophagy. The role of these processes in the functioning of the body.
6. Intercellular junctions, adhesive molecules.
7. The aging of the organism.
8. Stem cells - their types and occurrence. The use and acquisition of stem cells.

**Laboratory classes:**

1. Orientation to Course. Syllabus Review. Introduction to Histology and Cytophysiology. The cell. The cell nucleus: nuclear envelope - structure: the outer and inner nuclear membranes, perinuclear cisterna, nuclear pores, nuclear lamina and nuclear matrix. Chromatin - The orders of DNA packing (I. DNA double helix,II. Nucleofilament 10-nm chromatin fiber, III. Solenoid 30-nm fiber, IV. Loops of solenoid, V. Chromosomes). Nucleosome. Barr body. Heterochromatin. Euchromatin. Nucleolus - structure and function. Cell membranes: Biochemical components – lipids (phospholipids), proteins (integral and peripheral membrane proteins), carbohydrates (glycocalyx). Membrane organization – fluid mosaic model; unit membrane; biological membrane properties; transport across membranes; plasma membrane. Endoplasmic Reticulum: Rough endoplasmic reticulum – structure and function, Smooth endoplasmic reticulum – structure and function. Mitochondria: structure, function, location. Golgi Complex: structure – cis face and trans face, function, location, flow of materials through the Golgi complex. Lysosomes: structure, function, primary and secondary lysosomes. Cytoskeleton: Microfilaments, Intermediate filaments, Microtubules – structure, types, role in medical diagnostics. Centrioles: structure, function
2. Epithelial tissue. Characteristic features of epithelia. Function. Classification. Specific epithelial types: Simple squamous epithelium; Simple cuboidal epithelium; Simple columnar epithelium; Pseudostratified epithelium; Stratified squamous epithelium; Stratified cuboidal epithelium; Stratified columnar epithelium; Transitional epithelium. Microvilli, Cilia, Flagella, Stereocylia – structure and function. Intercellular junctions: types, structure and function. Basal lamina and basement membrane – structure and function. Glands: Exocrine and endocrine glands – definition. Structure of exocrine glands. Classification of exocrine glands. Way of secretion: merocrine, apocrine, holocrine.
3. Connective tissue. Components of connective tissue: Ground substance – glycosaminoglycans (GAGs), proteoglycans, glycoproteins, Fibers – collagen fibers (structure, mechanical properties, collagen synthesis, collagen types); elastic fibers (structure, mechanical properties); reticular fibers (structure, mechanical properties), Cells – fibroblasts, fibrocytes, plasma cells, mast cells, macrophages mesenchymal cells, reticular cells. Connective tissue types: Connective tissue proper: loose and dense (regular and irregular), mucous connective tissue (Wharton’s jelly), reticular connective tissue, adipose tissue (white and brown). Cartilage – hyaline, elastic and fibrous – structure and location.

Blood, bone marrow, bone. Blood: Composition of plasma, Formed elements – blood cells (size, number, lifespan of mature cells, cell morphology: Erythrocytes - morphological structure and function, abnormalities, reticulocytes, hemoglobin, blood types – AB, A, B, O; Leukocytes - granulocytes: neutrophils, eosinophils and basophils; agranulocytes: lymphocytes and monocytes; Platelets – number, morphological structure, role in clotting. Bone marrow.

Bone: Bone cells, Bone matrix, Organization of spongy bone and compact bone: Osteon.

1. Muscle tissue. General features of Muscle tissue. Organization of Muscle tissue. Types of Muscle tissue. Skeletal muscle: Cells – morphology, Myofilaments – thin and thick filaments, organization of myofilaments, Sarcomere, Sarcoplasmic reticulum ; triads. Types of skeletal muscle fibers – red, white and intermediate. Mechanism of contraction. Cardiac muscles. Cells – morphology, Intercalated discs, Sarcoplasmic reticulum and T tubule system – dyads. Mechanism of contraction. Smooth muscle: Cells – morphology, Mechanism of contraction.
2. Nervous tissue. General characteristics. Cells of nervous tissue: Neurons – cell body; dendrites; axon; tigroid. Morphologic classification of neurons – unipolar, bipolar, multipolar pseudounipolar. Neuroglial cells – types: astrocytes (protoplasmic and fibrous)-morphology, location and function; Oligodendrocytes- morphology, location and function; Schwann cells- morphology, location and function; Microglia- morphology, location and functions; Ependymal cells. Synapses: classification, synaptic morphology. Nerve fibers: myelin sheath, nodes of Ranvier, internodes. Peripheral nerve: structure. Nervous system. Cerebral cortex. Cerebellum. Spinal cord. Ganglia.
3. Circulatory system. General organization of blood vessels: tunica intima – endothelium, subendothelial layer; tunica media; tunica adventitia. Types of blood vessels: arteries (elastic arteries, muscular arteries and arterioles)- morphological structure and function, veins (large, medium-sized and small veins, venules), capillaries – morphological structure (endothelium, basal lamina, pericytes), classification of capillaries (continuous, fenestrated, sinusoidal capillaries), their structure and location. Lymphatic vascular system: lymphatic vessels – structure.
4. Immune system. General organization – central and peripheral lymphoid organs. Cells of immune system: lymphocytes T and B, NK cells, plasma cells, antigen presenting cells - morphology, origin, function, Immunoglobulins, Immune response: humoral and cellular. Lymphoid organs: Lymph node – morphologic structure (cortex-lymphoid nodules, medulla), function, lymph flow through the lymph node. Thymus – morphologic structure (cortex, medulla; thymocytes, epithelial reticular cells, Hassal’s corpuscles), function, thymic hormones. Spleen - morphologic structure (white pulp and red pulp), function, blood flow through the spleen.
5. Partial test. Practical recognizing of slides. (45min)

**Semester 2**

**Seminars**

1. Development of the head and neck. Congenital craniofacial defects. Pharyngeal pouches and arches.
2. Tooth organ development. Odontogenesis of teeth in utero and in utero. Enamel-forming cells - ameloblasts. Dentinogenic cells - odontoblasts. The effect of intra-body and extracorporeal factors on tooth development.
3. Development, structure and functions of the temporomandibular joint. (45min)
4. Development of the digestive system and the basics of cytodiagnosis of oral smears.
5. Development of the respiratory system.
6. Development of the urinary system. Congenital kidney defects.
7. Development of the female and male reproductive system.
8. Development of the endocrine glands. Congenital defects of endocrine glands. Endocrine gland cytophysiology.

**Laboratory classes:**

1. Oral Cavity. Teeth. Mouth: structure and function. Teeth: tooth structure-enamel, cementum, dentin, pulp cavity, pulp, Tooth development. Gums: structure. Palate: structure. Salivary glands. Lips: wall structure (mucous membrane-epithelium, lamina propria; submucosa; skeletal muscle). Tongue: histological structure (mucous membrane, papillae: filiform, fungiform, foliate, circumvallate).
2. Salivary glands: parotid gland, submandibular glands, sublingual gland (histological structure: secretory portion and excretory ducts; types of glands; histophysiology. Liver, Pancreas, Gall Bladder. Liver: general structure and functions, blood supply, liver lobules (classic liver lobule, portal lobule, hepatic acinus of Rappaport), portal triad, cell types (hepatocytes, Kupffer’s cells, Ito cells), biliary system. Gallbladder: histological structure (mucous membrane, muscularis, adventitia and serosa). Pancreas: general structure and function, exocrine part (pancreatic acinar cells, centroacinar cells), endocrine part (islets of Langerhans).

Endocrine system. Hypophysis (Pituitary gland): Adenohypophysis – Pars Distalis (general structure; cell types: chromophobes, chromophils-acidophils /somatotropic cells, mammotropic cells/, basophils /gonadotropic cells, thyrotropic cells, corticotropic cells/; hormones secreted by chromophils and their effects; control of pars distalis; blood supply and hypophyseal portal system); Pars Tuberalis (histological structure; cell types); Pars Intermedia (histological structure; cell types). Neurohypophysis – Pars Nervosa (general structure; cell types: pituicytes and axons of secretory neurons from the supraoptic and paraventricular nuclei; neurohypophyseal hormones and their effects; control of pars nervosa); Infundibulum. Neuroendocrine Hypothalamo-Hypophyseal System (NHS). Pineal gland: general structure; cell types: pinealocytes and astroglial cells; function(melatonin); histophysiology-circadian biorhythms. Thyroid: general structure; follicular cells – morphology, normal function: synthesis, storage and liberation of thyroid hormones(T3, T4); targets of thyroid hormones; parafollicular cells (C cells) – morphology, location, function (calcitonin). Parathyroid glands: histological structure; cell types: chief cells and oxyphil cells; function (parathyroid hormone). Adrenal gland: Adrenal Cortex: general structure - zona glomerulosa, zona fasciculata, zona reticularis; function. (mineralocorticosteroids, glucocorticosteroids, adrenal androgenes); Adrenal medulla: structure; cell types – chromaffin cells; function (epinephrine, norepinephrine).

1. Digestive system. Esophagus: wall layers (mucous membrane-epithelium, lamina propria, esophageal cardiac glands, muscularis mucosae; submucosa-esophageal glands; muscular coat; adventitia). Stomach: wall layers (mucous membrane: surface epithelium (cell types), lamina propria, muscularis mucosae, submucosa, muscular coat, serosa); regional differences-cardia, fundus and body, pylorus; gastric pits; cardiac glands; gastric glands (structure, cell types: parietal cells, chief cells, enteroendocrine cells, mucous neck cells, undifferentiated cells, their functions); pyloric glands. Small intestine: histological structure (mucous membrane-surface epithelium: enterocytes; lamina priopria: intestinal glands-cell types; villi; submucosa-duodenal Brunner’s glands, muscular coat; serosa and adventitia); regional differences: duodenum, jejunum and ileum. Large intestine: histological structure (mucous membrane-intestinal glands, submucosa, muscular coat, adventitia and serosa). Appendix-histological structure, function.
2. Respiratory system: components and functions. Nasal cavity. Paranasal sinuses. Larynx: general structure; epithelia (types, location); laryngeal cartilages (types); vocal apparatus. Trachea: general structure – mucous membrane (epithelium-cell types, lamina propria, glands, cartilage), muscular layer, adventitia. Bronchial tree: bronchi-wall layers (epithelium, glands, cartilage), brioncholes-wall layers (epithelium), terminal bronchioles (Clara’s cells), respiratory bronchioles, alveolar ducts and sacs. Alveoli-alveolar cell types, pulmonary surfactant, blood-air barrier, alveolar lining regeneration.
3. Urinary system. Kidney: cortex and medulla; nephron: renal corpuscle (Bowman’s capsule-podocytes; glomerulus; mesangium; renal filtration barrier-components, functions); histological structure and histophysiology of renal tubule (proximal convoluted tubule, loop of Henle, distal convoluted tubule); collecting tubules and collecting ducts; juxtaglomerular apparatus; renal calyces and renal pelvis. Ureter: wall layers (mucous membrane-surface epithelium, lamina propria; muscular coat; adventitia). Urinary bladder: histological structure (mucous membrane-transitional epithelium, lamina propria; muscular coat; adventitia). Urethra.
4. Female reproductive system and Male reproductive system. Ovary: general organization: external coverings and internal structure; ovarian cortex-ovarian follicles: primordial, unilaminar primary, multilaminar primary, secondary, mature Graafian, atretic follicles; corpus luteum; corpus albicans; ovarian hormones; hormonal regulation of ovary-FSH and LH. Oviduct: wall structure, epithelium. Uterus: general structure; endometrium - stratum basale, stratum functionale: zona compacta and zona spongiosa, epithelium, changes in menstrual cycle; myometrium; serosa; uterine cervix – surface epithelia, cervical glands. Vagina: histological structure (mucosa-epithelium, lamina propria; muscularis; adventitia). Testis: general organization: external coverings and internal structure (lobules); seminiferous tubules: seminiferous epithelium-spermatogenic cells and supportive Sertoli’s cells, basal lamina, tunica propria; interstitial Leydig’s cells; blood-testis barrier; tubuli recti; rete testis; ductuli efferentes. Epididymis: histological structure and function (surface epithelium). Ductus deferens: wall layers. Seminal vesicles: histological structure and function. Prostate gland: histological structure and function. Penis: general organization-corpora cavernosa, corpus spongiosum.
5. Skin and ear. Eye. Skin: epidermis (cell layers, keratinocytes-keratinizing system, melanocytes-melanin synthesis, Langerhan’s cells, Merkel’s cells), dermis and hypodermis; sweat glands: eccrine and apocrine; sebaceous glands. Hairs: follicle and hair structure. Fingernail: histological structure. Mammary gland: general structure, resting gland and lactating gland. Ear: external ear, tympanic membrane; middle ear; internal ear-vestibular organs, cochlea.

Eye: tunica fibrosa: cornea, sclera; tunica vasculosa (uvea): choroid, ciliary body, iris; tunica interna (retina): layers of retina, fovea centralis, optic disk; lens-histological structure.

1. Partial test. Practical recognizng of slides. (45 min)